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Studies on effect of post harvest treatments on quality and shelf life of custard apple (*Annona squamosa* L) cv. BALANAGAR

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ABSTRACT : An attempt was made to determine the most effective post harvest treatment to extend the storage life of custard apple fruits. The results revealed that the application of the wax emulsion at 10 per cent recorded significantly minimum PLW (7.51%) as compared to other treatments. The treatment also recorded the highest acidity (0.34%), lowest TSS (20.73%), lowest rotting (16.15%) and maximum marketable fruits (71.38%) after five days of storage. The organoleptic scores for colour , flavour, texture and taste also superior in the treatment. However, application of wax emulsion 12 per cent also recorded at par values for the above parameters.

KEY WORDS : Custard apple, Wax emulsion, Organoleptic, Storage, Shelf life

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Custard apple is mostly used as a desert fruit for its delicious taste and nutritive value. Due to its climacteric nature, it ripens fast and with the slightest pressure the fruit easily get disintegrates into segments. Hence, the post harvest loss is a great handicap in exploiting full potential of the crop in increasing the production and farm income. Therefore, enhancing shelf life of the fruit is the most important factor for getting remunerative profit. Thus, the present study was conducted to know the effect of chemicals and packages on storage life of the custard apple fruits.

RESEARCH METHODS

The present investigation was conducted at Horticulture Research Station, Bijapur (Tidagundi), University of Horticultural Sciences, Bagalkot (Karnataka) during the year 2009-10 and 2010-11.The fruits after harvesting were subjected to different treatments *viz.*, wax emulsion @ 6 (T_1), 8 (T_2), 10 (T_3) and 12 per cent (T_4) and keeping the fruits in 100 guage polyethylene bag +2 per cent vent (T_5), 150 guage polyethylene bag +0.5 per cent vent+ $KMnO_4$ (T_6), 200 guage polyethylene bag + 0.5 per cent vent + $KMnO_4$ (T_7), 250 guage polyethylene bag +2 per cent vent (T_8), and control (without treatment). Each treatment consisted of 20 kg fruits of uniform size and maturity and they were replicated thrice. The experiment was laid out in a Completely Randomized Design with three replications. The observations on PLW, TSS, acidity and rotting percentage were recorded on 2,4 and 5 days after storage and at the end of the storage period marketable fruits and economics were worked out. The organoleptic evaluation for colour, flavour, texture and taste was carried out with ten expert panels and depending on the score card (5 point scale) the data were pooled and analyzed statistically.

RESEARCH FINDINGS AND DISCUSSION

The data presented in Table 1 indicated that the physiological loss in weight and TSS of custard apple fruits was significantly affected by post-harvest treatments. The minimum PLW (7.51%) and TSS (20.73%) were recorded in T_3 which was at par with T_4 while it was maximum in case of control (15.53% of PLW and 27.33% of TSS) at the end

of storage period (5 DAS). The lowest values with respect to PLW and TSS might be due to low rate of respiration and transpiration caused by wax coating. The findings are supported by Bojappa and Venkatesh Reddy (1990) in sapota and Jakhar and Singh (2008) in aonla.

The titrable acidity and fruit rotting as affected by different post-harvest treatments also varied significantly (Table 2). The maximum titrable acidity (0.34%) and minimum fruit rotting (16.15%) at the end of storage period was recorded with the application of 10 per cent wax emulsion (T_3) Similarly, treating the fruits with 12 per cent wax emulsion also recorded at par values. However, maximum fruit rotting was observed in untreated control (51.44%). The lowest rotted fruits in the above treatment might be due to inhibition of sporulation and spore germination of rot causing fungus by wax coating treatment. Jakhar and Singh (2008) also reported lowest rotting due to post harvest treatment with neem leaf extract in case of aonla fruits.

The marketable fruits obtained at the end of storage period (5DAS) was found to be maximum in T_4 (71.94%) which was at par with application of wax emulsion 10 per cent. However, the lowest marketable fruits (31.07%) were recorded in untreated control (T_9). A reason behind this could be due to lowest PLW and rotting was recorded in T_3 and T_4. The results of organoleptic evaluation (Table 3) at the end of storage period reveal that the maximum scores with respect to colour (3.93), flavor (4.11), texture (4.22) and taste (4.11) were recorded in fruits treated with wax emulsion 10 per cent. However, T_1, T_2 and T_4 were also statistically similar with respect to colour retention.Whereas, lowest scores with respect to colour (2.49) and texture (2.89) were recorded in untreated control and flavour (2.78) and taste (2.67) in T_6 treatment. The possible cause for the highest

Table 1 : Effect of different post- harvest treatments on PLW and TSS of custard apple fruits cv. BALANAGAR (Pooled data of 2009-10 and 2010-11)

Treatments	PLW (%)			TSS (%)		
	2 DAS	4 DAS	5 DAS	2 DAS	4 DAS	5 DAS
T_1 - Wax emulsion 6 %	4.11	7.86	10.26	22.20	24.70	25.30
T_2 - Wax emulsion 8 %	5.32	8.41	10.49	22.07	24.80	24.57
T_3 - Wax emulsion 10 %	3.28	4.58	7.51	17.53	20.83	20.73
T_4 - Wax emulsion 12 %	3.47	5.22	7.69	19.40	19.93	21.27
T_5 -Poly bag 100 gauge + 2 % vent	5.49	6.08	9.18	21.53	22.53	24.03
T_6 - Poly bag 150 gauge + 0.5 % vent + $KMnO_4$	6.66	9.76	12.17	22.23	24.07	23.93
T_7 - Poly bag 200 gauge + 0.5 % vent + $KMnO_4$	4.31	8.19	13.43	22.17	23.30	24.80
T_8 - Poly bag 250 gauge + 2 % vent	3.68	5.76	8.86	19.37	21.20	24.17
T_9 - Control	7.89	12.47	15.53	23.20	25.40	27.33
Mean	7.69	9.08	10.57	21.08	22.97	24.01
S.E. $\pm$	0.306	0.515	0.597	1.148	0.95	0.90
C.D. (P=0.05)	0.917	1.543	1.789	3.442	2.849	2.702

DAS-Days after storage

Table 2 : Effect of different post -harvest treatments on acidity, rotting and marketable fruits of custard apple cv. BALANAGAR (Pooled data of 2009-10 and 2010-11)

Treatments	Acidity (%)			Rotting (%)		Marketable fruits (%)		
	2 DAS	4 DAS	5 DAS	4 DAS	5 DAS	2 DAS	4 DAS	5 DAS
T_1 - Wax emulsion 6 %	0.41	0.33	0.28	21.24	26.55	95.89	70.90	59.10
T_2 - Wax emulsion 8 %	0.38	0.34	0.29	19.15	24.30	94.68	72.44	62.41
T_3 - Wax emulsion 10 %	0.45	0.37	0.34	11.34	16.15	96.72	84.08	71.38
T_4 - Wax emulsion 12 %	0.40	0.36	0.32	11.89	17.61	96.53	82.89	71.94
T_5 -Poly bag 100 gauge + 2 % vent	0.39	0.31	0.27	21.05	28.90	94.51	72.89	55.24
T_6 - Poly bag 150 gauge +0.5% vent + $KMnO_4$	0.40	0.26	0.22	24.81	36.15	93.34	65.43	47.70
T_7 - Poly bag 200 gauge +0.5%vent + $KMnO_4$	0.35	0.25	0.21	26.55	41.55	95.69	65.26	42.35
T_8 - Poly bag 250 gauge + 2 % vent	0.35	0.32	0.28	29.45	40.15	96.32	64.79	45.11
T_9 - Control	0.36	0.33	0.29	36.82	51.44	92.11	50.70	31.07
Mean	0.39	0.32	0.28	22.48	31.42	92.31	69.93	54.03
S.E. $\pm$	0.05	0.02	0.01	1.45	1.71	1.22	0.80	2.78
C.D. (P=0.05)	NS	0.05	0.04	4.43	5.19	3.65	2.43	8.34

DAS-Days after storage, NS=Non-significant

Table 3: Organoleptic Evaluation of custard apple fruits cv. BALANAGAR after storage period (5 DAS) (Pooled data of 2009-10 and 2010-11)

Treatments	Color	Flavor	Texture	Taste
T_1 - Wax emulsion 6 %	3.56	3.00	3.11	3.11
T_2 - Wax emulsion 8 %	3.50	3.11	2.89	3.34
T_3 - Wax emulsion 10 %	3.93	4.11	4.22	4.11
T_4 - Wax emulsion 12 %	3.83	4.00	3.96	3.89
T_5 -Poly bag 100 gauge + 2 % vent	3.22	3.89	3.44	3.33
T_6 - Poly bag 150 gauge + 0.5 % vent + $KMnO_4$	3.22	2.78	3.00	2.67
T_7 - Poly bag 200 gauge + 0.5 % vent + $KMnO_4$	3.11	3.11	3.33	3.33
T_8 - Poly bag 250 gauge + 2 % vent	3.00	3.22	3.11	3.44
T_9 - Control	2.49	3.22	2.89	2.89
Mean	3.26	3.38	3.30	3.35
S.E. $\pm$	0.19	0.27	0.22	0.16
C.D. (P=0.05)	0.57	0.81	0.65	0.47

DAS-Days after storage

Score Card					
Grades	Excellent	Very good	Good	Fair	Poor
Score	5	4	3	2	1

Table 4 : Effect of different post –harvest treatments on economics (Rs./100kg fruits) (Pooled data of 2009-10 and 2010-11)

Treatments	Marketable fruits (%)	Gross return (Rs.)	Cost of treatment (Rs.)	Net return (Rs.)
T_1 - Wax emulsion 6 %	59.10	1182	500	682
T_2 - Wax emulsion 8 %	62.41	1248	600	648
T_3 - Wax emulsion 10 %	71.38	1428	700	728
T_4 - Wax emulsion 12 %	71.94	1439	800	639
T_5 -Poly bag 100 gauge + 2 % vent	55.24	1105	500	605
T_6 - Poly bag 150 gauge + 0.5 % vent + $KMnO_4$	47.70	954	600	354
T_7 - Poly bag 200 gauge + 0.5 % vent + $KMnO_4$	42.35	847	650	197
T_8 - Poly bag 250 gauge + 2 % vent	45.11	902	550	352
T_9 - Control	31.07	621	100	521
Mean	54.03	1080	556	525
S.E. $\pm$	2.78	-	-	-
C.D. (P=0.05)	8.34	-	-	-

Selling price of the fruits - Rs.20-00/kg

sensory values in T_3 could be due to presence of thin coating of wax emulsion over the surface of the fruit leading to reduction in oxygen concentration. As a result, the respiration of fruits may be minimized due to which the degeneration of colour and softening of fruit tissues reduced. These results are in conformity with the findings of Haribabu *et al.* (1990) and Singh *et al.* (2006) in custard apple and Sharma *et al* (2006) in kinnow mandarin fruits.

The economics of different treatments also revealed that the highest gross returns per 100 kg fruits of Rs.1439 was obtained in treatment T_4 (wax emulsion 12%). It was followed by T_3 (wax emulsion 10%) (Rs.1428). However, net returns (Rs.728) was highest in fruits treated with wax emulsion 10 per cent. The highest gross returns and net returns in above treatments attributed to highest marketable fruits with lowest PLW and rotting percentage of fruits obtained at the end of storage period.

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